

# Ambient Frictions: Place-conscious Frictions to Foster Intentional Technology Use

Solomon Pitluck  
Jones College Preparatory High School  
Chicago, Illinois United States  
smpitluck@cps.edu

Anup Sathya  
Computer Science  
University of Chicago  
Chicago, Illinois United States  
anups@uchicago.edu

## ABSTRACT

As digital devices become increasingly embedded in daily life, the home—once a refuge for rest and connection—has become a site of constant connectivity and distraction. With information now accessible anytime and anywhere, the spatial and temporal boundaries that once structured our routines are rapidly dissolving. While many existing digital wellbeing interventions rely on app-level restrictions or cognitive nudges, they often overlook the critical role of physical and spatial context in shaping digital habits. This research introduces place-conscious frictions: subtle, spatially grounded interventions that prompt users to reflect not only on when they use technology, but where. By asking “Why here?” these frictions encourage users to intentionally shape their home environments, defining zones that support different modes of engagement and presence. By embedding interventions into the material fabric of the home, this work advances a more context-aware and humane approach to digital wellbeing—one that supports user agency, reduces problematic smartphone use, and helps reestablish the home as a space for reflection, care, and meaningful connection.

## CCS CONCEPTS

Human centered computing → Activity centered design; User centered design; Interaction devices

## KEYWORDS

Digital wellbeing; home automation; ambient objects; internet of things; persuasive technology; deterrent technology; screen time; prototyping

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## 1 INTRODUCTION

Smartphone addiction has recently become the subject of scrutiny, and for good reason: A Mental Health America report states that individuals reporting poor mental health

are significantly more likely to believe that technology makes them feel distracted, addicted, overwhelmed, frustrated, and worthless, with 75% of all survey recipients claiming to be “heavily reliant” on technology [6]. Self-help articles abound with tips to unplug, with one titled “How to Break Free from Your Phone” [4]. Smartphone addiction is largely as a result of persuasive techniques employed by big tech companies to increase engagement and therefore revenue [1][5]. Ambient frictions (Ambient deterrent technologies, disruptive technologies), however, could potentially be used to counteract these techniques, disrupting addictive relationships with smartphones in the specific place they are used. Our research is focused on using a home automation interface that takes user input to control prototype ambient frictions in order to answer the research question “How can spatially-aware, culturally attuned, and materially embedded frictions within the home be designed, enacted, and evaluated to support intentional, value-aligned technology use and foster healthier relationships with domestic space and information access?”

## 2 DESIGN METHODOLOGY

In order to determine which ambient frictions might be successful, a brainstorming survey was conducted with 10 lab members external to the project, who were asked to conceive of potential ambient frictions and rank them on a scale from “not disruptive enough” (frictions that are too undistruptive to modify their habits) to “too disruptive” (frictions that are so disruptive they risk the user’s wellbeing).

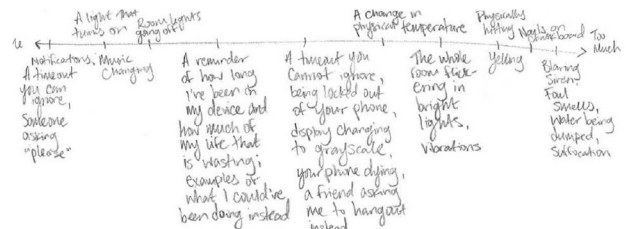
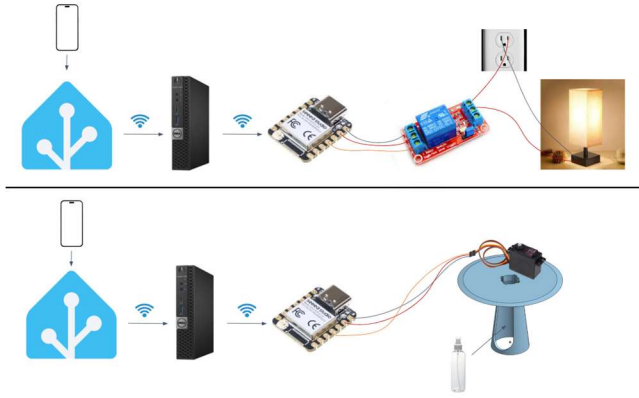


Figure 1: Sample Survey Response

The results of the survey were then analyzed for commonalities in the middle “just right” range, revealing a preference for light and olfactory senses. These two options were further developed into prototypes.

### 3 HOME AUTOMATION AND PROTOTYPES

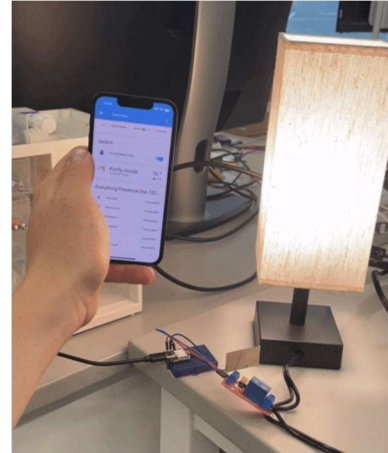


**Figure 2:** Components and Pipeline for Light Friction (top) and Sprayer Friction (bottom)

Ambient frictions must be triggered when the user completes a certain action. The most ideal system to detect actions and trigger technologies reactively within a home setting is a home automation system [3]. To ensure ease of programming and setup, Home Assistant was used on the user and server side. To control physical components the ESP platform was used, with an ESP32C3 being selected for its minimal footprint and ESPHome software for connectivity between Home Assistant and the ESP32C3. With this initial setup two prototype ambient frictions were constructed, the software and hardware pipeline for both illustrated in Figure 1 above.

#### 3.1 THE LIGHT PROTOTYPE

A proof-of-concept prototype was made with a simple relay setup. The user completes a negative action on their phone, such as exceeding a screen time limit, which prompts their Home Assistant app to send a signal to the Home Assistant server. The server then sends a signal via ESPHome to the ESP32C3, which toggles a relay repeatedly to flicker a light. This is a proof-of-concept as it demonstrates the ability of a phone signal to control an item in physical space.



**Figure 3:** The light prototype functioning. To simplify visualization, the trigger is a slider rather than another user action.

#### 3.2 THE SPRAYER PROTOTYPE

The sprayer prototype is a more advanced ambient friction. As with the light prototype, the user completes a negative action on their phone, which prompts their Home Assistant app to send a signal to the Home Assistant server, which sends a signal via ESPHome to the ESP32C3. The ESP32C3 in this case triggers a servo, which operates a simple rack and pinion that depresses the nozzle of a sprayer bottle. This sprays the area the user occupies with the substance in the bottle. The bottle can be interchanged and refilled at will, offering a high level of customization.

**3.2.1 Function.** The bottle is to be filled with water or a liquid with a scent that is unpleasant to the user. Note that the smell need not be foul necessarily, but rather an olfactory reminder that the user is off task.

**3.2.2 Form.** The prototype is mushroom-shaped, following a popular biophilic design trend [6] and has a translucent top with a light fixture controllable through Home Assistant. This makes it a viable home good and gives it function outside of operating as an ambient friction, supporting the user to keep and use the item.

**3.2.3 Speculative extension.** A future prototype may be battery powered for ease of positioning, may have a variety of aiming mechanism to specifically target the user, and may have different bottles to positively reinforce good behavior by spraying a pleasant scent.

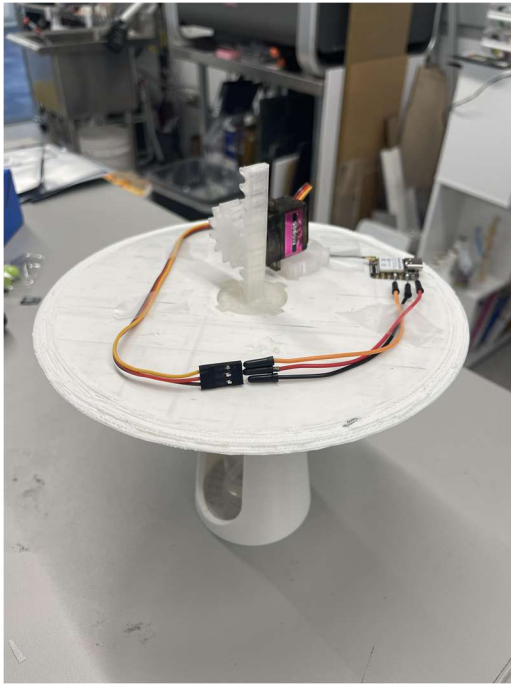


Figure 4: The sprayer prototype's servo mechanism



Figure 5: The sprayer prototype fully assembled

## CONCLUSION

We explore how ambient friction prototypes can be designed and implemented to potentially alter environments to become places in which technology use is intentional and healthy. We designed two prototypes, a light and a mushroom-shaped sprayer, triggered by a home automation system taking data from user smartphones. We plan to test their efficacy to determine the viability of widespread ambient friction systems during the 2025-26 academic year.

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